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ABSTRACT

This report addresses the relationship between education and creativity in Japan, with a focus on four issues. First, the definition and measurement of creativity is discussed. Approaches to the measurement of creativity are presented and criticized, and different meanings of creativity (i.e., originality, deviation from the group, self-expression, and achievement) are discussed. Second, evidence is reviewed from Western psychological and educational research on the factors which promote or inhibit the development of creativity. Third, Japanese education is discussed in light of the Western research findings on the factors which promote or inhibit creativity. Finally, creativity is discussed as a larger societal issue in Japan, with a view to the societal indicators which might be used to measure creativity. A number of factors are identified which may encourage the development of creativity in Japanese children, including: relatively non-controlling early child rearing, high development of basic skills which provide the basis for creative accomplishments, an emphasis on persistence and repeated practice for mastery, and educational practices which foster intrinsic motivation. Other factors are identified which may inhibit the development of creativity in Japanese children, including the rote memorization required for examination preparation, the possible impact of the examinations in undermining intrinsic motivation, and the possible low tolerance for deviation from conventional thought. (Author)

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CREATIVITY AND JAPANESE EDUCATION

Report to the United States Study of Education in Japan

Office of Educational Research and Improvement

Department of Education

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Catherine C. Lewis

This report addresses the relationship between education and creativity in Japan, with a focus on four issues. First, the definition and measurement of creativity is discussed. Approaches to the measurement of creativity are presented and criticized, and different meanings of creativity (i.e., originality, deviation from the group, self-expression, and achievement) are discussed. Second, evidence is reviewed from Western psychological and educational research on the factors which promote or inhibit the development of creativity. Third, Japanese education is discussed in light of the Western research findings on the factors which promote or inhibit creativity. Finally, creativity is discussed as a larger societal issue in Japan, with a view to the societal indicators which might be used to measure creativity. A number of factors are identified which may encourage the development of creativity in Japanese children, including: relatively non-controlling early childrearing; high development of basic skills which provide the basis for creative accomplishments; an emphasis on persistence and repeated practice for mastery; and

educational practices which foster intrinsic motivation. Other factors are identified which may inhibit the development of creativity in Japanese children, including the rote memorization required for examination preparation, the possible impact of the examinations in undermining intrinsic motivation, and the possible low tolerance for deviation from conventional thought.

EXECUTIVE SUMMARY

CREATIVITY AND JAPANESE EDUCATION

Catherine C. Lewis

This report discusses issues in the relationship between creativity and Japanese education. It is divided into four parts. Part I discusses the definition and measurement of creativity, based on a systematic review of Western research and theory on creativity, mainly from the disciplines of psychology and education. Part II reviews Western research on the factors which promote or inhibit the development of creativity in children. Part III reviews research on Japanese education (and, to a lesser extent, childrearing) in the context of Part II's conclusions about the factors which influence the development of creativity. Part IV attempts to go beyond current research and to discuss issues relating to creativity in contemporary Japan. Each Part is summarized below.

Part I: Definition and Measurement of Creativity

Although definitions of creativity vary widely, a shared component of many definitions of creativity is the twin features of originality and usefulness of the creative product. However, Western writings on Japan discuss many senses of creativity other than originality and usefulness. These include: achievement; willingness to tolerate deviation from the group; and self-expression. The relationship between these factors and originality is not well understood; the importance of distinguishing creativity (i.e., something original and useful) from self-expression, achievement, and deviation from the group is discussed. A major dimension along which definitions of creativity differ is whether the target measured is the creative product, process, situation or personality. Three approaches to the measurement of creativity are discussed: creativity tests, societal indicators, and the consensual assessment technique. A major problem with creativity tests is their questionable validity with respect to socially meaningful creative achievement. A major problem with societal indicators (such as patents, Nobel prizes, or publication of novels) is the influence of extraneous factors not related to creativity. The consensual assessment technique measures creativity by obtaining reliable subjective judgments of creativity from experts within a field. Although a promising technique, it has not been extensively applied.

Part II: Influences on Creative Behavior

Part two reviews research on the factors which influence the development of creativity in children. Evidence on childrearing suggests that relatively non-restrictive parenting promotes creativity in children. Theoretical models of creative behavior suggest that three

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categories of factors influence creativity: task-related skills; creativity-related skills; and motivation. Task-related skills are those related to a particular domain (e.g., knowledge of chemical properties or ability to visualize figures in three dimensions). Research suggests that creativity is related to good memory and fluency with basic knowledge in a domain. Creativity-related skills include more general skills, such as a cognitive style appropriate to creative problem-solving, a tendency to use "broad" organizational categories, etc.. The third component of creativity is motivation. Intrinsic motivation (the desire to engage in an activity for reasons intrinsic to the activity) has a documented relationship to creativity.

Part III: Japan: Influences on Creativity

Evidence on Japanese education and child development suggests certain practices likely to foster creativity and others likely to inhibit creativity. Japanese early childrearing appears to be low in restrictiveness, a factor likely to promote creativity. A high level of training in basic skills in both academic and nonacademic subjects is a second factor likely to promote creativity in Japan. The memorization-oriented education for entrance examinations may, however, inhibit the development of creativity for several reasons, including: teaching memorization strategies based on trivial aspects of information rather than on meaningful conceptual organization; and direction of attention to an extrinsic goal which would undermine intrinsic motivation and creativity. A third negative impact of the examination system may be to screen out of competitive higher education individuals with creative abilities not tapped by entrance examinations, or to screen out individuals with uneven verbal-quantitative abilities or uneven interests. Accounts of the Japanese arts suggest that creativity is considered to be a product of years of imitation of set forms, not a spirit which is initially to be brought to an artistic endeavor. Interpretations of the role of drill and imitation in Japanese education need to take into account this cultural difference in perception of the link between imitation and creativity. There is evidence, too, that originality may be less valued in Japan than in the U.S. as a component of intelligence, and may be less predictive of success in school. Observations of preschool and early elementary school suggest that behavioral conformity is demanded of Japanese children in certain areas typically outside school regulation in the U.S. (e.g., hygeine, out-of-school behavior), but that these behavioral demands coexist with self-expression in the classroom.

Evidence on three creativity-related skills is examined: problem-finding; self-expression; and tolerance for rejection of conventional thinking. Accounts of Japanese industrial innovation suggest that problem-finding (noticing a problem where others do not) is a creativity-related skill

in which Japanese may excel; this skill may be linked to a tendency to be unsatisfied with current levels of performance, or to choose a high standard of comparison. Evidence on self-expression in Japanese education is limited, but suggests that self-expression may be encouraged during early education, but not during secondary education; however, during secondary education it may be encouraged in extra-academic activities. Evidence is also limited on the extent to which rejection of conventional thinking is tolerated; again, evidence suggests an environment relatively supportive of divergent thought during early education, but not during secondary education.

Diverse evidence suggests a high level of motivation among Japanese students. Childrearing and elementary education appear to use techniques which foster intrinsic motivation to learn; however, the examination system is a powerful external force which may undermine students' interest in the intrinsic rewards of learning. Some Japanese educators view Japanese university education as of low caliber compared to primary and secondary education and compared to other countries; this is often attributed to the negative impact of the examination system on students' motivation.

Part IV: Creativity in Japan: Approaches to Understanding and Measurement

Recent reports on several industries suggest that the stereotype of Japanese as "only" imitators incapable of creative innovations may be inappropriate. Various indices of creativity in the realm of business and industry are discussed, including patents and small business formation rate. The role of individuals who "champion" new products is discussed, and the Japanese conditions which promote champions (development of "masters" rather than "managers" and valuing of persistence) are pointed out. Several potential indices of creativity in scientific research are discussed, including scientific papers published and prizes. Some aspects of creativity in Japan may not be captured by the domains of creativity typically studied in the U.S. (the arts, sciences, etc.); Japanese creativity in assimilating Western technology and in developing products might be described as a form of interpersonal or social creativity. Examples of this social or interpersonal creativity include developing work arrangements which allow workers to contribute to production innovations and adapting products in ways responsive to human needs. The final section of the report documents the concern of Japanese educators with creativity, and particularly with the possible detrimental effects of the entrance examination system on creativity at the levels of secondary and post-secondary education.

I. DEFINITION AND MEASUREMENT OF CREATIVITY

A. Introduction: Creativity and Western Views of Japan

> I discuss the subject of creativity with considerable hesitation, for it represents an area in which psychologists generally whether they be angels or not, have feared to tread. (Guilford, 1968, p.77)
>
> The term creativity is used with something approaching gay abandon.... (Nicholls, 1972)
>
> Definitions of creativity range all the way from the notion that creativity is simple problem-solving to conceiving it as the full realization and expression of all of an individual's unique potentialities. (MacKinnon, 1970)

The study of creativity has intimidated, confused, and yet fascinated researchers. Broadly, we can identify four targets of creativity study: the creative process; the creative product; the creative person; and the creative situation. Our choice of target is intimately bound up with our theories about the causes of creativity and with our choice of tools to study creativity. For example, if we believe that creativity is a stable trait of individuals, we might conduct cross-cultural research on the aspects of childrearing which influence creativity, using personality tests designed to identify the creative personality. If, on the other hand, we believe that creativity is a product of

certain situations (such as "brainstorming"), we might scrutinize the differences between Japan and the U.S. in the ways groups typically engage in problem-solving.

MacKinnon (1970) wrote "One would be ill advised to seek to choose from among these several meanings the best single definition of creativity, since creativity properly carries all of these meanings and many more besides. Creativity is, indeed, a multi-faceted pheonomenon." Following the spirit of MacKinnon's advice, this report will not focus on a narrow definition of creativity. Rather, we will review evidence on the many facets of personality, product and process which have been called "creativity."

This report is based mainly on published and unpublished works in the areas of psychology, education, and Japanese studies. I also draw on my own field studies of Japanese nursery schools (Lewis, 1984) and of 15 Tokyo first grade classrooms (conducted in 1985; manuscript in preparation). In addition, I am greatly indebted to the more than two dozen educators, researchers, and administrators (both within and outside the Ministry of Education) who shared their views about educational policy, pedagogy, and research as it relates to creativity in Japan.

The impact of Japanese social and educational practices on creativity has been an issue of intense discussion, though not of concomitantly intense research. While some observers portray Japanese society as rich in creative accomplishments in the arts and industry (e.g., Vogel, 1979;

Torrance,1980; see section C2 on societal indicators of creativity), others posit an inability to conceive original ideas as a critical failing of Japanese society. Differences in the definition of creativity may partially account for this disparity. At least four different senses of "creativity" seem to inform writings on Japan.

1. Originality

Novelty, such as new ideas or new combinations of existing ideas, is a frequently discussed issue with regard to Japan. The notion that Japanese success is built on skillful adaptation of ideas which originated outside Japan is frequently repeated, and frequently disputed. We will look at the factors in Japanese education which may facilitate or inhibit this component of creativity: the tendency to produce novel ideas or solutions.

2. Deviation from the Group.

In discussing the issue of creativity in Japan with American and Japanese researchers, I was surprised by the frequent mention of conformity and uniformity as indices of lack of creativity in Japan. For example, the tendency of school children to have a uniform way of arranging contents in their backpacks, and the tendency of Japanese adults to order the same dish when eating as a group in a restaurant were both offered as examples of "lack of creativity". Whether or not conformity in behavior is predictive of low

originality (i.e., low production of novel ideas), the two appear to be linked in the minds of many observers.

3. Self-expression.

Self-expression, including aesthetic and emotional expression, is a third sense in which researchers use the word "creativity." This aspect of creativity often overlaps with "originality", but may also be distinct. For example, children's "creative writing" may not be original, in the strict sense of novel ideas, but may be thought valuable for the experience it gives in awakening or developing expression of emotional and aesthetic impulses.

4. Achievement.

Some writings on Japan equate creativity with achievement (e.g., Torrance, 1980). This is not surprising in view of the common linking of the two aspects of behavior. For example, "gifted and talented" are often combined for educational purposes, virtuosity is studied as an aspect of creativity, etc.. While psychologists may continue to debate the relationship between creativity, achievement and intelligence (e.g. Crockenberg, 1972; Cronbach, 1970; Nicholls, 1972), there is evidence that at least some measures of creativity are independent of measured intelligence (Wallach & Kogan, 1965). However, most models of creativity include attention both to intelligence and to achievement. Intelligence is often posited to be a

necessary but not sufficient condition for creativity. In other words, creative people are usually intelligent, but intelligent people are not necessarily creative. However, many researchers do not believe that there is a simple relationship between creativity and intelligence (e.g., Guilford, 1981); the relationship between creativity and intelligence probably depends greatly on the nature of the creative domain in question. Achievement is frequently regarded as an index of creativity and also as a means of assessing motivation toward creative accomplishment (e.g., Walberg,1969; MacKinnon,1968). Particularly if we wish to compare real-life societal indicators of creativity, rather than specially derived IQ-independent or achievement-independent measures, it is likely that indices of creativity will also measure, to a greater or lesser extent, achievement and intelligence.

While there may be many other senses of "creativity", concern with originality, achievement, distinctiveness from the group, and self-expression appear to characterize much of the western interest in creativity in Japan. Of the four aspects of creativity outlined above, originality would seem to have the most obvious relationship to scientific progress and economic benefit. However, we know very little about the interconnections, if any, among the four aspects of creativity. It is possible that a high degree of

originality may be dependent on a social or educational climate which tolerates substantial diversity of individual behavior and which de-emphasizes individual conformity. However, it is also possible that any apparent relationship between orignality and social conformity is simply a figment of Western cultural biases. This review includes evidence on all four aspects of creativity. It is important to keep in mind the distinction among these aspects and the lack of evidence regarding possible interconnections.

B. Measurement of Creativity

Reviews of creativity research reveal diverse approaches to the measurement of creativity, and suggest that this diversity has been a major stumbling block in the progress of creativity research (see, for example, Amabile, 1982). Major approaches to the measurement of creativity include the following.

1. Creativity Tests.

A common approach to the measurement of creativity, particularly during childhood, has been the use of standardized tests. These tests are reviewed in standard reference works on assessment (e.g., Cronbach, 1970; Buros, 1974 ; Goodwin & Driscoll, 1982) as well as by creativity researchers (e.g., Amabile, 1982). Among the most widely used batteries is the Torrance Tests of Creativity (Torrance, 1962). Subtests measure both verbal and artistic

creativity, and include tasks such as thinking of as many different uses as possible for a common object, and writing stories on unusual topics (e.g., the dog that doesn't bark). The scoring of the test takes into account the number, variety, statistical infrequency, and degree of development of the ideas generated. The Torrance Tests of Creativity are typical of many creativity tests in form, content, administration, and scoring.

The relationship between performance on creativity tests and production of creative products is not clear (see reviews by Amabile, 1982, and Cronbach, 1970) . In particular, conceptual definitions of the creative product suggest that it must not only be novel, but also be appropriate or useful. Standardized tests measure novelty more readily than appropriateness, which, Amabile argues, is best measured by consensual judgments of experts within a given field. Cronbach (1970) presents evidence that one test of creativity, The Remote Associates Test, does show impressive validity with real-world indicators of creativity, including patents, scientific productivity, research grants, and rated creativity.

A second problem with creativity tests is that they are designed to assess the variance in creativity due to personality traits, and not that portion due to environmental influences. In looking at creativity in Japan, we will be interested both in influences of

personality and in influences of environment (e.g., how tasks are structured or rewarded) on creativity.

2. Societal Indicators.

A second approach to the measurement of creativity is societal indicators. For example, Japan's high number of inventions and patents, high number of novels published yearly, and the content of the trade imbalance between the U.S. and Japan have all been cited as evidence of Japanese innovation and creativity (Torrance, 1980; Seward, 1977; Vogel, 1979). While such indicators have obvious appeal, they may have less obvious shortcomings. For example, the use of patent rate as a form of Japanese inter-company competition may inflate Japan's patent rate relative to the U.S.; the content of the trade imbalance may be influenced by trade barriers; per capita newspaper reading rates may mask reading of very different materials; etc.. While this review will cite relevant indicators wherever possible, their limitations should be kept in mind.

3. Consensual Assessment.

A third approach to measurement of creativity is to have creative products rated by multiple experts in the field, resulting in reliable, subjective judgments (Amabile, 1982). For example, by this technique, artists and art teachers rating the creativity of children's collages showed very high inter-rater reliabilities (.77 to .88).

This would seem to be a very promising technique for cross-cultural research. For example, the creativity of product innovations or of children's science projects could be evaluated by a group of experts in the relevant field.

II. INFLUENCES ON CREATIVE BEHAVIOR

This section briefly identifies and discusses factors which have been demonstrated or posited to influence creativity. As noted above, our definition of creativity is broad, and includes the creative personality, process and product. After the factors which influence creativity are briefly discussed, the subsequent section presents evidence on Japan. With a few exceptions, both the evidence on the factors which influence creativity and the evidence on the Japanese situation is very thin. This section might better be read as a catalogue of hypotheses than as a review of established findings. Nevertheless, it may provide a useful checklist of the concerns which we need -- or need not -- keep in mind as we examine Japanese educational practices which we may wish to emulate in the United States.

What are the factors which inhibit or promote creative performance? We will briefly review evidence on childrearing and creativity, and then review Amabile's (1983) model of the components of creative performance. Amabile's model (see Figure One) identifies three major components of creative performance: domain-relevant skills (e.g., knowledge of nuclear physics); creativity-relevant

skills (e.g., breaking perceptual set, suspending judgment); and task motivation. It should be noted that the discussion of influences on creativity is based on Western theory and empirical research.

1. Influences of Parenting Styles on Creativity

Perusing any library or bookstore section on childrearing suggests that creativity can be fostered through appropriate early childrearing. Titles abound such as "Guiding Your Child to a More Creative Life". Research on the childrearing antecedents of creativity is limited. Much of the existing research investigates the two dimensions of parent behavior which are at the core of much developmental psychology research: warmth and control. A 1982 review by Rejskind concludes that there is mixed evidence regarding parent warmth and children's creativity, but much firmer evidence regarding parent control styles and children's creativity. Control refers to a dimension of adult behavior which ranges from high control or restrictiveness, at one end, to high autonomy-granting or independence at the other. While the 18 studies reviewed by Rejskind employed a wide variety of measures of control and of creativity, the overall pattern of results suggests a clear and positive, if not always strong, relationship between parent autonomy-granting and children's creativity.

The notion that the individual can actualize creative potential only if given "psychological freedom", or only if possessing the freedom to explore unconscious impulses, has also been at the root of many psychoanalytic and phenomenological theories of creativity (Anderson, 1965; Hacker, 1965).

2. Task-related Skills

An essential prerequisite for creativity, according to most accounts, is thorough mastery of the skills and knowledge of the domain of creative endeavor. Amabile (1983) calls this set of prerequisites "domain-relevant skills", and identifies subcategories including knowledge, talent, and technical skills. Such domain-relevant skills might include, for example, detailed knowledge about the properties of various chemical compounds, advanced proficiency on a musical instrument, or the ability to imagine a three-dimensional structure from a two-dimensional drawing. Most theorists propose that task-related skills are the product both of innate abilities and of education and experience.

There is a popular notion that too much knowledge of a given subject matter reduces creativity. (This is sometimes humorously referred to as the "immaculate perception" notion of creativity.) Amabile's (1983) summary of evidence suggests just the contrary: "an increase in domain-related skills can only lead to an increase in creativity, provided that the domain-relevant information is organized

appropriately." (p.364). By "appropriately", Amabile means knowledge which is organized according to general principles, rather than as specific, narrowly applicable collections of facts. As we will see below, the issue of "appropriate" organization of knowledge is a key issue with respect to the acquisition of knowledge for Japanese entrance examinations.

3. Creativity-Related Skills

The preceding section discussed the acquisition of basic skills related to a particular domain of endeavor: for example, brush-painting techniques or information about chemical properties. This section discusses more general "creativity" skills which cut across various domains of creative endeavor. These skills might be thought of as the "something extra" which distinguishes creative performance from performance which is merely highly competent. Amabile's (1983) conceptual framework identifies three categories of creativity-related skills. These include a cognitive style appropriate to creative problem-solving; conscious or unconscious knowledge of the strategies for generating novel ideas; and a work style conducive to creative achievement. We will briefly examine each of these areas in turn.

Cognitive Style Appropriate to Creative Problem-Solving

Amabile (1983) includes in this category such aspects of cognitive style as breaking out of perceptual set (e.g., envisioning an unusual use of an object); keeping response options open (e.g., approaching a canvas without a definite plan for a painting); generating ideas while suspending evaluative judgments; remembering accurately; critically examining one's own problem-solving process; and using "broad" organizational categories which forge relations between apparently diverse bits of information. An additional aspect of cognitive style important to creativity may be "problem-finding". Research suggests that one difference between highly creative and less creative individuals is that creative individuals notice problems where others do not (Guilford, 1968). As MacKinnon (1970) wrote:

> The creative process starts always with the seeing or sensing of a problem. The roots of creativeness lie in one's becoming aware that something is wrong, or lacking, or mysterious. One of the salient traits of a truly creative person is that he sees problems where others don't.... (p.20)

Thus, the process of problem-finding may be an essential part of the creative act.

Knowledge of the Strategies for Generating Novel Ideas

The second category of creativity-related skills identified by Amabile (1983) is knowledge, either intuitive or explicit, of strategies for generating novel ideas. These include such strategies as "when all else fails, try

something counterintuitive" (Newell, Shaw & Simon, 1962); or use of case studies or paradoxical incidents to generate hypotheses. (McGuire, 1973).

Work Style Conducive to Creativity

In this category, Amabile (1983) includes such elements of work style as the ability to concentrate efforts for long periods of time, and such personality characteristics such as perseverance in the face of frustration, absence of conformity in thinking, and low dependence on social approval.

Although Amabile (1983) reviews considerable research linking the three categories of creativity-relevant skills described above with creative achievement, current research is far from definitive in several respects. First, most creativity-related skills have been studied only for one or a very limited range of creative domains. They may or may not be helpful in other domains. For example, suspending evaluative judgment in order to "brainstorm" may aid in generating new ideas for product development, but may prove unhelpful or even distracting and detrimental to creative problem-solving in theoretical physics. In fact, quite different skills may be needed for creativity in different domains or even during different phases of a single creative endeavor (Nicholls,1972). For example, problem "finding" may demand skills antithetical to those required for problem "solving."

A second problem is the as yet unestablished cross-cultural validity of the creativity-related skills identified by American research. Although much has been written regarding the personality characteristics, such as low social conformity, which facilitate creative achievement (e.g., MacKinnon, 1968; Stein & Heinze, 1960) these personality characteristics may differ across cultures. For example, an anecdote reported by Ouchi (1981) suggests that different social conditions may promote creativity in Japan and the U.S.. An American company's program to solicit productivity improvement suggestions from Japanese employees was a dismal failure as long as rewards were offered for individuals' suggestions; a switch to group rewards for group suggestions stimulated a flood of new ideas from employees. Employees explained to an American manager that they were embarrassed to suggest ideas as individuals because "production improvements come from watching others." Although it is common for Americans to think of creativity as the result of individual maverick genius, research by Ouchi (1981) suggests that highly successful and innovative American companies in the U.S. are likely to show strong emphasis on shared group responsibility and other features typical of large Japanese corporations.

4. Motivation

Motivation is the final influence on creativity in Amabile's model. Amabile (1983) calls motivation: "the most

important determinant of the difference between what a person can do and what he or she will do" (p.366). Researchers have been particularly interested in the impact on creativity of "intrinsic" versus "extrinsic" motivation. Intrinsic motivation is the desire to engage in an activity because of properties of the activity itself (e.g., enjoyment of tinkering in the laboratory). In contrast, extrinsic motivation is the desire to engage in an activity because of extrinsic rewards (e.g., money, grades, praise). Intrinsic motivation is a product both of personality and of situation. For example, people differ in the extent to which they intrinsically enjoy tinkering in a laboratory. Situations differ in the extent to which external rewards are offered for tinkering.

One of the most intriguing findings of intrinsic motivation research is that, under certain conditions, salient extrinsic rewards for engaging in an activity may undermine an individual's instrinsic motivation to engage in that activity. For example, by promising children rewards for coloring pictures with magic markers, researchers actually reduced children's subsequent coloring (when rewards were no longer given) (Lepper, Greene, & Nisbett, 1973). Similar decrements in performance were not seen among children who were not rewarded or who were rewarded incidentally (i.e., not promised the reward as a condition of participation). How can the negative impact of a promised reward be explained? The children promised a

reward may have come to perceive themselves as coloring only in order to receive the reward, and this self-perception may have decreased their subsequent interest in coloring when not rewarded. The promised rewards may also have focused children's attention on the rewards, reducing their attention to and enjoyment of the process of coloring.

Several studies directly link extrinsic motivation to decreased creativity. Amabile (1979) found that anticipation of external evaluation reduced the creativity of children's art work. Amabile (1985) also found that questions focusing creative writers' attention on the extrinsic reasons for writing reduced the creativity of poems written; questions focusing on intrinsic reasons for writing increased the creativity of poems written. Decrements in creativity when a reward is offered for performance have been shown by other researchers for other age groups as well (e.g.,Kruglanksi, Friedman, & Zeevi, 1971). Diverse evidence also suggests that anticipated rewards may prompt individuals to alter their problem-solving styles, including: to attempt easier problems, to be less efficient in information acquisition, to make more errors and stereotypical responses; to achieve less "incidental" learning, and to be more "answer" oriented and less logical (Condry, 1977; Maehr & Stallings, 1972). Children's creativity may be greater under game-like than under test-like conditions (Dentler and Mackler, 1964).

Like reward, other practices such as surveillance or evaluation which direct attention to the extrinsic aspects of tasks may undermine intrinsic motivation. For example, children's intrinsic motivation to engage in a task can be undermined by surveillance alone (Lepper and Greene, 1975). With a reduction in intrinsic motivation may come reduced attention to the process of tasks, including reduced creativity. For example, the ability to "break mental set" when an entirely new problem approach is necessary can be undermined by offering a reward, although performance on more routine, difficult problems is not (McGraw and McCullers, 1979).

It is important to recognize the boundaries of the negative impact of rewards. Amabile's (1983) review of the impact of reward on creativity suggests that rewards are not detrimental to intrinsic motivation in all circumstances. For example, if reward is perceived as an exchange for services offered (as in the case of salary) or as an incidental "plus" by an individual who is already highly intrinsically motivated (e.g., a scientist who wins a Nobel Prize), it may not have the power to affect self-perception and task attitude. It is possible that systems of early childrearing and education which foster intrinsic motivation may create individuals who are relatively "immune" to the detrimental effects of extrinsic rewards. The interaction between personality and social institutions may mean that a given social institution (e.g., the examination system)

could have quite different effects if exported to a different society. Hypothetically, it is possible that examination-oriented education could operate in Japan without undermining intrinsic motivation because of a strong early educational emphasis on intrinsic enjoyment of education, but that examination-oriented education would have devastating consequences for U.S. students. It should be emphasized, however, that this mere speculation, meant to illustrate the possible interactions between personality and social institutions.

Research on eminent creative individuals in various fields also suggests a strong role of intrinsic motivation in creative achievement. Self-initiated, task-oriented striving is a distinguishing characteristic of creative scientists as well as of creative writers (Chambers, 1964; Barron, 1963). Creative architects, compared to their less creative peers, tend to be guided by self-generated standards of excellence rather than by conformity to professional standards (MacKinnon, 1962,1968). Campbell (1960) suggests that motivation plays a major part in the repetition of "thought trials" necessary to arrive at a new idea:

> The number of trials necessary to arrive at a new construction is commonly so great that without something of a fascination for the subject one grows weary of the task. This is the emotional condition of originality of mind in any department (Bain, cited by Campbell, 1960, p.385).

An aspect of creativity widely cited in subjective accounts of the creative process but omittted from many psychological accounts is the desire for self-expression. The creative act may represent a means for "coming to grips with ideas and emotions of great significance, ones that cannot be articulated and mastered through ordinary conversational language" (Gardner, 1982, p.90). Isadora Duncan is quoted as saying "If I could say it, I wouldn't have to dance it." Although the impact on creativity of educational strategies which promote self-expression has not been systematically studied, encouraging children's expression of emotion through various artistic media has been a central feature of many programs designed to stimulate chidren's creative development (Torrance, 1962; Maynard, 1973; Anderson, 1965).

III. JAPAN: INFLUENCES ON CREATIVITY

This section reviews evidence on the factors which may promote or inhibit creativity in Japan. The evidence in organized in sections which correspond to those in the previous part (i.e., parental styles which foster creativity, development of task-related skills, development of creativity-related skills, and motivation).

A. Evidence on Japanese Parental Styles

Evidence reviewed in the previous part suggests that low restrictiveness by parents is related to high creativity

in children. Evidence from diverse sources suggests that, at least through early elementary school, Japanese parents fall at the very low end of the continuum of restrictiveness (Hara and Wagatsuma, 1974; Vogel,1963; Lewis, 1984; Benedict, 1946). Japanese mothers tend to avoid making explicit demands on their children and do not enforce rules when children resist. Amae, sometimes translated as "indulgence" has been described as the centerpin of Japanese early childrearing (Doi, 1973). The early childhood years in Japan may well be a time of freedom unparalleled in the life of an American child (Benedict, 1946). While evidence on Japanese childrearing during middle childhood and the adolescent years is somewhat more sparse than for the early years, anthropological accounts do not suggest any sharp discontinuity in childrearing. It has been suggested that, at least traditionally, parents transfer much responsibility for the more unpleasant parts of childrearing, such as restrictions and punishment, to other social institutions, perhaps including the school (Benedict, 1946; Hara and Wagatsuma, 1974; Singleton & Singleton, 1984).

The American studies of parenting styles related to children's creativity do not, for the most part, identify the specific behaviors related to high creativity in children. Nevertheless, on the level of global dimensions such as restrictiveness vs. autonomy-granting, Japanese childrearing during the early years does appear to approximate the situation of low restrictiveness which

empirical work and theory suggest is a key condition for the development of creative potential.

B. Japanese Education: The Acquisition of Task-Related Skills

1. Japanese Achievement in Skill Acquisition

Diverse sources suggest that the Japanese educational system is excellent, perhaps even the best in the world, in imparting knowledge and skills in a number of areas of subject matter. Best known are the high scores of Japanese youth on international tests of science and mathematics (Walberg, 1986; Comer & Keeves, 1973; Walberg, Harnisch & Tsai, 1984). Recent comparisons of mathematics achievement among Japanese, Taiwanese, and American first and fifth graders demonstrate that Japanese children exceed American children in mathematics achievement as early as the first grade, and that this difference is not attributable to differences in innate cognitive abilities (Stigler, Lee, Lucker & Stevenson, 1982). Nor is the difference likely to be accounted for by differences in the mathematics curriculum in the two countries, since achievement differences appear even for concepts which have been taught in both countries. Rather, the researchers point to such factors as amount of time spent in mathematics instruction, children's attentiveness to instruction and time spent on homework as possible keys to the cross-national differences in achievement.

Less publicized but equally impressive are Japanese achievements in literacy. With a literacy rate of greater than 99%, Japan is perhaps the most literate nation in the world. (The Soviet Union also claims very high literacy; see Woronoff, 1983). The Japanese accomplishment is particularly noteworthy if we remember that the Japanese language has two syllabaries, each with 46 letters, 1850 required ideographs (some very complicated, with 20 or more strokes), and a thousand or more additional characters not required in the Ministry of Education's formal curriculum but necessary for a high degree of literacy. To make matters more complicated, most ideographs have multiple pronunciations. Previous theories notwithstanding, the ideographic writing system does not protect children against dyslexia or reading disability (Stevenson, Lucker, Lee, & Stigler, 1982).

Japanese school achievements in music, art, and physical education are also noteworthy. For example, all Japanese learn to read music and to play several musical instruments. Common activities in the first grade curriculum include drawing the human body in various postures from a live model, and observing and drawing morning glories. By the end of elementary school, children have had hundreds of hours of experience not only with traditional art materials such as clay, various paints, papers, and print-making materials, but also with tools such as a scroll saw and

cutting pliers, and with complete design and construction of useful objects.

2. Memorization and Creativity

The preceding litany of Japanese accomplishments could be extended considerably (see Vogel, 1979; Torrance, 1980). It appears that Japanese education provides a high level of training not only in academic subjects, but also in non-academic and aesthetic pursuits. But does the nature of this training facilitate subsequent creative achievement in the humanities, mathematics, science, and the arts? As noted above, thorough knowledge and skill of a given domain is essential to creative achievement in the domain. But certain types of learning, particularly emphasis on general principles, are likely to facilitate creativity. Other types of learning, including rote memorization and learning which de-emphasizes meaning, may not facilitate creativity. In the words of a well-known cognitive psychology researcher, "the more we concentrate on...heavily contextualized (specific) concepts and propositions, the less capacity we will have available to learn general principles and questions that crosscut different areas and perspectives" (Wickelgren, 1979, p.382).

Does Japanese education emphasize rote memorization or meaningful integration of concepts? While the answer to this question is a matter of some debate (e.g., Saeki & Miyake, 1986; Taniuchi & White, in press), several generalizations may be drawn from existing research. First,

early and primary education probably emphasize general principles and thinking skills more than does secondary education, which may emphasize memorization more strongly.

Second, there is probably a major difference in the teaching of thinking vs. memorization between what we might call Japan's official and "shadow" school systems. Public and private schools comprise the official school system; juku (after-school schools) including exam preparation schools ("cram" schools) comprise Japan's shadow school system. Although good statistics are not available, the majority of Japanese secondary school students, and perhaps the majority of upper elementary school students as well, probably attend after-school schools (juku) designed to improve performance on junior high, high school, or college entrance examinations (Taniuchi & White, in press). (This figure does not include juku which focus on non-exam subjects such as calligraphy, music, swimming, or English conversation; these juku will be discussed briefly in the section on aesthetic education.) Research on after-school schools has been limited. However, the picture of these schools which emerges suggests rote memorization of large bodies of factual material, intense competition and ranking of students, and frequent tests of memorized material (Taniuchi & White, in press). Japanese "examination hell" is infamous even in the United States. Since accounts of the Japanese examination system, and the stresses it places upon children, families, and teachers, exist elsewhere, they

will not be recounted here. (See Vogel,1979; Vogel,1963; Woronoff, 1983; Rohlen, 1983; Cummings, 1980; Cummings, Amano, & Kitamura, 1979). Two potential effects of the examination system on creativity should be noted. One, the impact of the examination system on students' subsequent motivation to learn, will be discussed in the section on motivation and creativity. The second is the impact of examination preparation on students' ways of thinking and integrating information; this issue will be discussed here.

What sorts of memorization and thinking skills are required by university entrance exams? Rohlen (1983) writes:

> Emphasis is on mastery of facts, control over details, and practiced skill in the application of mathematical and scientific principles. As most anyone with experience in exam taking realizes, some forms of learning and knowledge can be tested with precision and some are measured inadequately by the inherent nature of virtually any question-answer approach. Science and math fit the short-answer mode comfortably, humanities and social science do not. (p.95).

Figure Two reproduces Rohlen's translation of an item from the 1974 entrance examination to Kobe University. The item dramatically demonstrates the degree of factual knowledge demanded by entrance examinations; Greek history comprises only a fraction of the material which must be mastered by students. The sheer volume of material to be mastered means that classroom teachers jeopardize students' entrance examination performance by "wasting" time discussing the meaning, implications or relevance to contemporary thought

of the material presented. Rohlen writes that the emphasis of Japanese education is on

> disciplined apprenticeship in which, through arduous study, basic knowledge is memorized. The student is trained first to be a patient, persistent worker, a good listener, one preoccupied with details and correctness of form. Unlike many of their American counterparts, they do not learn a glibness that has little foundation in knowledge. But Japanese students learn to keep their thoughts largely to themselves, even as their minds mature (pp. 269-270).

What is the impact on creativity of this "disciplined apprenticeship?" Does the experience of memorizing large bodies of factual information obviate, or even undermine, skills of critical thinking and the ability to forge conceptual links? One possibility is that these skills are learned equally well in Japan but not openly demonstrated in the Japanese high school. A second possibility is that these skills are learned somewhat later in Japan. A third possibility is that the centering of education on memorization results in lasting deficits in critical and analytic thinking skills. Although no data are available on the influence of examination-oriented memorization on analytic skills, Walberg's (1986) analysis of data obtained by the International Association for the Evaluation of Educational Achievement provides some evidence on Japanese children's analytic skills in mathematics. Japanese 10- and 14-year-olds outperformed students in compulsory school in other countries not only on items requiring information, but also, and by a greater margin, on subsections tapping

understanding, application, and higher processes such as hypothesis formation. These subsections tap the most creative aspects of mathematics.

The connection between information and analytic skills in Japanese mathematics proficiency underlines the considerable psychological research and theory which links expertise or creativity in a domain with detailed and accessible knowledge of the domain. Walberg (1986) reviews evidence from Simon (1981), Newell & Simon (1972), Simon (1978) and others suggesting that experts differ from novices in science, chess, and some other fields in having more information in permanent memory, being able to bring it into conscious memory rapidly, and having items of information elaborately linked so that information can be retrieved by alternate links if certain links are lost. In a similar vein, Newell et. al. (1962) write: "there is a high correlation between creativity (at least in the sciences) and proficiency in the more routine intellective tasks that are commonly used to measure intelligence" (p.145).

Walberg's findings and the psychological research and theory in the area raise the possibility that, however distasteful to Americans, the herculean efforts of memorization which are the heart of Japanese secondary (and perhaps late primary) education may not be harmful, or may even be beneficial, in the development of creatively functioning experts. However, two shortcomings of current

knowledge should be noted. First, psychological theory and research suggest that memorization of large quantities of factual information would be beneficial only to the extent that it is meaningfully organized, using cross-cutting conceptual principles, rather than specific tricks of memory. For example, let us consider two ways of memorizing the functions of the various muscles in the body. One student memorizes the function of each muscle in the body by visualizing the movement which could not be conducted without that muscle. A second student devises a clever acronym linking muscle names and function names. The first student, who memorizes using meaningful associations, may set up a much more enduring, creatively enabling, knowledge network than the second student. It would be useful to know what strategies Japanese youth use to memorize the vast stores of knowledge required for the entrance exams; I did not find research on this topic, but conversations with Japanese adults revealed that acronymns and other memory "tricks" are explicitly taught and practiced for studying some bodies of information, particularly in languages and the social sciences. If widely practiced at examination time, an interesting question then becomes whether these strategies can be discarded, and strategies which better facilitate conceptual integration and creativity adopted, in adulthood.

A second unanswered question is the impact of examination-centered education on creativity in the

non-sciences. The theories and research which link creativity to greater and more accessible information stores and proficiency on routine intellectual tasks are concerned with scientific creativity. It is possible that the skills which facilitate creative endeavor in the social sciences and humanities differ from those described for the natural sciences, and that the impact of the examination system may be particularly detrimental to creativity in these "softer" areas. This is a hypothesis which remains to be tested.

3. Screening by the Examination System: Impact on Creativity

An additional impact of the examination system on creativity may be to screen out of higher education, or screen out of the more competitive institutions of higher learning, individuals with certain creative abilities who do not "test well." Examples might be individuals with highly discrepant quantitative and verbal abilities, individuals who are intensely interested in one area of subject matter but not in others, and individuals with creative skills not tapped by the entrance examinations either to academic or performing arts schools (e.g., creative writers, debaters, individuals with a genius for diplomacy or politics). MacKinnon (1968) reports that creative architects, in comparison to their less creative peers, tended to achieve high grades only in the courses which interested them:

> ...creative persons share, then, the fundamental characteristic of not being particularly interested in achieving in situations which demand conforming behavior but, rather, are strongly motivated to achieve

in situations that demand independence in thought and action.... (p.152).

4. Practice, Mastery, & Creativity: The Japanese View

Although "examination hell" is a recent phenomenon in Japanese society, the emphasis on persistent, repetitive practice to achieve mastery of a skill seems to be a relatively enduring quality of traditional Japanese learning. Learning by repeated practice (rather than by explanation or experimentation) and by mastery of set forms (with only minor innovations after many years of study) are features of education in many traditional Japanese arts and trades (Rohlen, 1976; Singleton & Singleton, 1984; White & Taniuchi, unpublished manuscript). As Rohlen points out, in Japanese aesthetic pursuits, freedom is an end product of years of devotion to mastery of established forms, not a prerequisite for artistic expression. Herrigel (1953), a student of Japanese archery, eloquently makes this point:

> Far from wishing to waken the artist in the pupil prematurely, the teacher considers it his first task to make him a skilled artisan with sovereign control of his craft. The pupil follows out his intention with untiring industry. As though he had no higher aspirations he bows under his burden with a kind of obtuse devotion, only to discover in the course of years that forms which he perfectly masters no longer oppress but liberate. He grows daily more capable of following any inspiration without technical effort, and also of letting inspriation come to him through meticulous observation. The hand that guides the brush has already caught and executed what floated before the mind at the same moment as the mind began to form it, and in the end the pupil no longer knows which of the two -- mind or hand -- was responsible for the work. (p.60)

What all of this suggests is that repetitive tasks and imitation of set forms may have a very different relationship to creative endeavor in Japan than in the United States. Despite -- or perhaps because of -- this emphasis on mastery of set forms, many Japanese arts have produced highly creative products and individual practitioners.

Mastery of established forms through repetitive practice is more than simply a pedagogical technique; it is the path to self-cultivation (Rohlen, 1976; Singleton & Singleton, 1984). Practicing calligraphy or piano is not simply acquiring a skill; it is a form of spiritual self-improvement. The Suzuki method for teaching violin is known in the United States mainly for its ability to produce extraordinary musical accomplishment in the very young; yet, the avowed goals of the program are not to train musicians, but to cultivate "sensitivity, service to others, and nobility of character" (Taniuchi, & White, in press). As Taniuchi notes, when the Suzuki method is practiced in the United States, the spriritual components are often lost, and the pragmatic goal of producing skilled musicians becomes paramount. Practice, self-improvement, and creative achievement are linked in Japanese pedagogy. Anthropologist Thomas Rohlen reports being told by his teacher of Japanese painting: "All of your academic work which has integrity will pay off in your art." (Rohlen, personal communication, 1985).

In view of the intense social criticism directed at the examination system in contemporary Japan (Cummings, Amano, & Kitamura, 1980), it would be naive to regard examination-oriented education as a natural outgrowth of mastery-oriented traditional teaching styles. Nevertheless, the parallels between mastery of examination information and mastery of skills in traditional arts do exist. In the traditional arts, repetitive practice and memorization of set forms is compatible with creative achievement. While the intellectual domain may differ from the artistic in the conditions which nurture creative accomplishments, the possibility of creative intellectual accomplishments through emphasis of memorization and mastery of factual information cannot be discarded.

5. Mastery of Forms and Creativity: Gardner's Theory

Gardner's (1982) theory of creativity in children provides an interesting perspective on the Japanese emphasis on basic skills. Gardner seeks to explain the transition from the "golden age of creativity" during the preschool years to the "literal stage" of early elementary school, when children whose speech and drawings had formerly qualified them as poets and artists suddenly "limit their graphic efforts to the faithful copying of forms about them." (p.88) Unlike many educators interested in creativity, who villify the school system for robbing children of their creativity, Gardner views the literal stage as a crucial phase of development: the time for

mastering rules. He posits that a quite different set of educational strategies may foster creativity during the preschool years and during the later "literal phase" of elementary school:

> During the natural artistry of the preschool years, active intervention is unnecessary; simply equipping children with materials (paints or xylophones) and exposing them to works (stories or drawings) suffices. But with the onset of school and the preoccupation with rules and convention, the environment must assume a more active role. This is a time when children crave knowledge of how to do things: they want to know how to play an arpeggio, render a drawing of a building in perspective, or write a mystery (or even a parody of Sherlock Holmes). Accordingly, teachers willing to instruct and models of how to do things become crucial.
>
> Indeed, I suspect that there exists a kind of "sensitive period" during the years preceding adolescence. The future artist needs to acquire skills at a rapid rate so that by adolescence he is already accomplished in his craft. If he is, he can then withstand the rise in critical powers of his adoelscent years and still conclude, "I'm not that bad."

In response to questions about the best way to stimulate creative development in elementary school students, the majority of the Japanese elementary school principals and teachers whom I interviewed stated that mastery of basics during elementary school lays the foundation for creativity. It appears that some psychological theory draws the same conclusion.

6. Creativity as a Japanese Cultural Value

Several sources of evidence suggest that Japan and the U.S. may differ on the cultural value placed upon creativity. As discussed above, creativity in the Japanese arts is achieved through repetition and mastery of

prescribed forms. Deviation from the prescribed forms is a mistake, not creativity, unless one has already achieved mastery by devoting to the art the many years necessary to attain the status of expert. Self-expression and originality, in and of themselves, may not be valued as highly in Japan as in the U.S.(White & Taniuchi, unpublished manuscript; Rohlen, 1976; Singleton & Singleton, 1984). For example, Azuma and Kashiwagi's investigation of Japanese concepts of the intelligent person (manuscript under review) found originality to be a relatively unimportant component of concepts of intelligence. Nor does originality predict academic success in Japan to the extent that it does in the U.S.(Kashiwagi, Azuma, Miyake, Nagano, Hess, & Holloway, 1984). Longitudinal research on the predictors of school achievement in the U.S. and Japan reveals that originality at age 4 predicts school achievement at age 11-12 in the U.S. but not in Japan. In contrast, persistence at age 4 predicts later school achievement in Japan but not in the United States. These findings suggest that originality in the U.S., and persistence in Japan, enable children to succeed in their respective educational systems. Other data from the same study suggest that Japanese mothers emphasize conformity to social standards, while U.S. mothers emphasize verbal self-assertiveness, as developmental tasks during the preschool years (Azuma, Kashiwagi, & Hess, 1981).

Observations of Japanese elementary schools by Taniuchi (Taniuchi & White, in press) and Lewis (in preparation)

suggest that enforcement of uniform standards of behavior may extend to different domains within Japanese classrooms than within U.S. classrooms. For example, classroom charts demonstrate the "correct" configuration for storing study materials in one's desk; detailed school procedures dictate the number of pencils and handkerchiefs which each child must bring to school daily, and scheduled self-evaluations of compliance occur; children practice washing their hands, opening their desks, and storing their belongings until they achieve a uniform standard of performance. While Americans tend to view such cultivation of uniformity as antithetical to individual expression and creativity, these practices coexist with an emphasis on self-expression in academic subjects as well as in art and music, and with encouragement of energetic, noisy, even rowdy behavior during some academic activities. Thus, early elementary education in Japan seems to value some qualities Americans associate with creativity (including self-expression and originality) while, in a manner reminiscent of the traditional Japanese arts, emphasizes disciplined mastery of prescribed forms in other areas such as hygeine, decorum, and neatness. Disciplined mastery and rowdy self-expression may not be contradictory educational goals; Japanese children may learn that both types of behavior are appropriate, depending on the setting.

C. Creativity-related Skills

1. Recognizing Problems: An Aspect of Creativity

> We hear a great deal about the 'divine discontent' of the creative person. It is said that Thomas A. Edison frequently admonished his workers with the comment, "There must be a better way. Go and find it." The uncreative, in contrast, are often willing to settle for half-way measures and tolerably successful solutions to problems. (Guilford, 1968, p. 107)

Problem-finding may be a creativity-related skill in which Japanese excel. Complacency is one enemy of creativity. A common feature of accounts of successful Japanese product development is Japanese recognition and solution of "minor" problems not recognized by other researchers. For example, the varistor (voltage-dependent resistor) is a device invented in Japan which prevents minute variations in voltage from causing instabilities on the television screen. Uchihashi (1983) suggests that the Japanese developed the varistor because they were not content to ignore the miniscule instabilities of the television screen, and "felt driven to spare no effort in investigating the cause of such instability." (p.16) Thus, they recognized and pursued a problem which others did not. Uchihashi attributes to the varistor the continued product competitiveness of Japanese television sets in foreign markets, despite their loss of cost competitiveness.

An unwillingness to be satisfied with current levels of performance may be a characteristic which cuts across many

aspects of Japanese performance. For example, studies reveal that Japanese children report lower levels of satisfaction with themselves than do U.S. or European children (see review by Kashiwagi, 1983). While this finding may be attributable to some extent to cultural differences in modesty or in response style, Kashiwagi argues convincingly that it also reflects different internal standards of comparison; Japanese children may choose as a reference point a higher standard of behavior. Nagano (1986) links the academic achievement of Japanese children to their feelings of low self-esteem: "As they feel incomplete they keep on trying to understand and memorize .... They are anxious to learn anything because of a sense of incompleteness or immaturity" (p.2). Speculatively, it is interesting to ask whether the choice of stringent standards of comparison may be related to standards chosen by classroom teachers. For example, while tests in U.S. high schools are typically constructed so that virtually all students score in the upper half of the possible point range, Japanese tests, particularly in certain subjects, are frequently constructed so that many students receive grades below 50%. (Lewis, personal observation; I found no systematic evidence, however, on this issue.) A similar observation may be made about the Japanese arts; expert or near-expert status is not achieved in a brief period of study. In many cases, years of devoted study are necessary even to graduate from the status of novice. Speculatively,

the tendency to choose a high standard of comparison, and to recognize problems in less-than-perfect performance, may be a creativity-related skill which is highly developed in Japan.

2. Self-expression in Japanese Education

Does the Japanese educational system promote self-expression by students? Rohlen's (1983) account suggests that encouragement of expression of emotions through regular academic activities is not a prominent feature of high schools, but that non-academic activities, including club activities, sometimes permit a degree of self-expression which would go beyond the bounds of propriety in the United States. Observations of Japanese elementary schools suggest that self-expression is an integral part of the curriculum in many areas (Lewis, in preparation). For example, first graders were observed in wild, free-form dancing to rock'n'roll music, in acting out music and stories with their bodies, in animated discussion of their "treasures" during a reading lesson about a boy's treasures, and in recalling at great length the smells, feelings and sights of potato-digging to write in a composition. In arithmetic classes focused on measurement, children gleefully devised such activities as lying on the floor to measure it in body-lengths, and standing on each others' shoulders to create an object taller than the

teacher. E. P. Torrance, a major proponent of educational strategies which foster self-expression, was deeply impressed with creative expressiveness he witnessed in Japanese preschools (Torrance, 1980).

3. Tolerance for Rejection of Conventional Thinking

Western accounts of creativity often mention the lack of conventionality of the creative person or product. Included in Newell, Shaw, & Simon's (1967) definition of creative problem-solving is that " the thinking is unconventional, in a sense that it requires modification or rejection of previously accepted ideas" (p.65). This definition suggests that a climate hostile to the "rejection of previously accepted ideas" might also be a climate hostile to creativity. Japanese classrooms at the secondary level may focus on memorization of accepted ideas, rather than on creating a climate which permits their rejection. The extent to which unconventional thinking is supported or stifled, and the long-term implications for creativity, are not known. Rohlen's (1983) account suggests that the busy high school curriculum simply may not include time for indulging in departures from conventional thinking in quest of creativity. Other accounts suggest that Japanese elementary education demands behavioral conformity by students in areas which U.S. schools might consider "personal", such as behavior when children are out of school, hygeine at home and school, etc.. (Taniuchi, & White, in press; Lewis, in preparation). Whether these

demands for behavioral conformity are accompanied by demands for intellectual conformity is not known. The Ministry of Education's control over textbook content has received sharp criticism: "text-book control and restriction of freedom in teaching make impossible an animated and creative atmosphere in the classroom and in home work" (Horio, 1979, p.2). In one textbook approval incident which received notoriety, the Ministry of Education failed to approve a well-respected work of literature because of certain unapproved sound effects (i.e., syllables which expressed the sounds of nature). The ensuing debate focused on whether the Ministry had the right to identify certain syllables, but not others, as correct expressions of natural sounds such as the movement of a stream. Rohlen's (1983) comments on Japanese textbooks also suggest a self-censorship of potentially controversial material:

> Although high school textbooks do not actually carry the strong imprint of official government attitudes, they have been purged of materials potentially critical of the government's position. And in order to appeal to teachers and avoid the scorn of the union, textbooks avoid topics and style offensive to the left. They are thus characterized by a bland neutrality on key social and political issues.... Authors also differ in the way they add touches of salt or pepper to subjects, but all avoid stronger spices. (p.249)

Intolerance of divergent ideas may also be bred by the examination system. As Rohlen (1983) observed, unusual or provocative interpretations of historical events are simply irrelevant to students who are preparing for examinations on factual content. That examination preparation may put

intellectual blinders on children, making them unwilling to entertain divergent, creative thoughts, has long been a concern to Japanese intellectuals. In the 1960's, essayist Hajime Yamashita made famous the child whose answer was marked wrong because, in response to the question "When snow melts, what does it become?" she said "spring."

Despite the probable impact of examinations in reducing tolerance for divergent thinking, informal observation of first grade classrooms and of elementary school mathematics education in Japan suggest that Japanese teachers recognize and praise a variety of children's approaches to mathematics and science problems (Easley & Easley, 1981; Lewis, in preparation). We do not yet know to what extent the stereotype of Japanese as uncreative may stem from highly visible conformities in behavior (e.g., "standard" clothing, group choice of the same meals, etc.) and to what extent Japanese education actually may foster intolerance for divergent thinking in the intellectual domain.

D. Japanese Education and the Development of Intrinsic Motivation

1. Use of Rewards in Japanese Classrooms.

Accounts of Japanese early childrearing, preschool education, and early elementary education all suggest that Japanese parents and teachers go to great lengths to help children develop a sense of internal control over both schoolwork and discipline. For example, the popular Suzuki

method of teaching violin to young children focuses on techniques for building children's interest in music. These include having the child watch the "mother`s" violin classes for months before the child is offered an opportunity to play; allowing the child to play violin only for short times when intensely interested; terminating each practice session before the child loses interest; etc. (Taniuchi, 1986). Nursery school teachers also use management techniques and disciplinary strategies likely to foster children's own desire to follow rules. For example, children "themselves" decide what the classroom rules will be; teachers' responses to misbehavior suggest not that offending children have willfully misbehaved but that they have "forgotten" or not "understood" the rules; much of the monitoring and enforcement of rules is left to the children themselves (Lewis, 1984).

The literature review in the previous section suggests that external rewards and evaluation can undermine children's intrinsic motivation and creativity. Rewards and grades are not emphasized in the early years of elementary education in Japan. For example, recent observations of 15 first-grade classrooms in Tokyo public elementary schools revealed that none of the teachers used what American teachers often call "motivators" (e.g., stars, prizes, rewards, etc.) for either behavioral or academic achievements. One progress chart for songs mastered on the pianica was observed and several classrooms had charts on

which children had themselves identified and charted progress on individual goals (e.g., "learning to write Chinese characters", "finishing all my lunch","playing outside without fighting"). Letter or word grades do not commonly seem to be written on children's work during the early grades, although teachers draw circles around items which are correct or particularly well-done. Torrance's (1965) classroom experiments suggest that students who assume a constructive, rather than a critical, attitude toward available information are able to produce a larger number of creative solutions and more original ones. Although Japanese primary school education would seem to foster a constructive, rather than critical, attitude toward information, secondary education may implicitly or explicitly emphasize criticism of poor performance on entrance examination material.

Pedagogical techniques during the early elementary school years also emphasize stimulating and fostering children's intrinsic interest in subject matter. A remarkable feature of the official Course of Study for Elementary Schools in Japan is the extent to which attitude, rather than simply performance, is the target of pedagogy. For example, goals include helping children "develop an attitude of willingness to express what they think about", helping children "experience the pleasure of intimacy...[with]....living things in their surroundings", etc.. The limited observations of elementary schools which

have been conducted suggest that these objectives are realized in practice with activities which mobilize children's interest and attention (Cummings, 1980; Easley & Easley, 1981; Lewis, in preparation). Children learn social studies by observing the equipment and rules in local children's parks and by drawing maps of their schools; they learn what makes objects sink by sailing home-made sand-weighted boats; they learn the need for measurement tools by devising ways to measure the classroom floor, and even trying human body-lengths. In summary, one striking emphasis of Japanese preschool and early elementary school education is attention to process as well as performance. Understanding, not compliance, is the first goal of discipline; enjoyment of subject matter (whether it be raising morning glories, locating and naming traffic signs, or recording "feelings about complex fractions" in a math diary) is a goal as important as mastery itself. High internal motivation to work among Japanese is also suggested by an international poll which asked youth in 11 countries "Why do you think man works?" Japanese were least likely among the young of the 11 nations to choose the instrumental response "to earn money;" a large percentage chose the response "to find self-fulfillment." (Cited in Cummings, 1980).

A second emphasis of Japanese elementary school education is on drill, repetition, and mastery of basics,

such as arithmetic tables and handwriting. Flashcards and penmanship books are common. Teachers often gear the pace to the average or slower student, and efforts to keep the brighter students from being bored are not as apparent as they might be in the U.S..(Cummings, 1980; Lewis, in preparation). One effect of the repetitive drill and relatively slow pace may be to teach children that academic work requires persistence, but that, with persistence, one can always succeed. Interview questions asking Japanese teachers how they treat children who "give up easily when they encounter a new word in a book" failed for an interesting reason: first-grade teachers claimed that children never encountered new words in reading, since all new words were practiced thoroughly before they appeared in books. Although further data on this issue are needed, early elementary school education in Japan may demand persistence and discipline (for tasks such as repetitive copying of characters) but may be at a sufficiently low level of difficulty that, with persistence, most children can succeed in performing well. If so, this may provide the ideal conditions for fostering persistence; children learn neither that tasks can be accomplished easily, without hard work, nor that they will fail even when they work hard.

Although available research suggests that conditions in the preschool and early elementary school may foster intrinsic motivation, curiosity, and enjoyment of the process of learning, later elementary school and secondary

school education appears to focus much more heavily on an external reason for learning: entrance examinations. One Japanese educational researcher has suggested that "docility", not curiosity, facilitates learning in the exam-centered system (Nagano, 1986).

The possibility that preparation for examinations might undermine subsequent intellectual motivation is confirmed by no less an intellect that Albert Einstein, who wrote that the process of "cram[ming] all this stuff into one's mind" for a physics examination was so unpleasant that afterward he could not bring himself to consider scientific problems for an entire year (Schilpp,1949). Einstein wrote:

> It is, in fact, nothing short of a miracle that the modern methods of instruction have not yet entirely strangled the holy curiosity of inquiry; for this delicate little plant, aside from stimulation, stands mainly in need of freedom; without this it goes to wreck and ruin without fail. (p.17)

Low-quality university education has frequently been cited as a consequence of the examination system. Critics argue that universities fulfill little educational function; rather they serve as gatekeepers and as holding facilities for students who will subsequently be selected and educated by corporations. The college years are commonly thought of as a time of relaxation and recovery from the hardship of "examination hell." One critic writes: "There is reason to fear that many students graduate from college knowing no more, and perhaps less, than when they entered" (Woronoff, 1983, p.149). Equally strident criticism of Japan's

universities comes from Michio Nagai, a former Minister of Education: "While I do not like to make predictions, if there is no change Japan's universities and her culture will rapidly deteriorate...." (Foreward to Cummings et. al., 1979, p.viii). The small number of Japanese university programs worthy of international reputation is also a problem identified in the recent First Report on Educational Reform (Prime Minister's Provisional Council on Educational Reform, 1985). It is sometimes said that corporations, not universities, are the real graduate schools in Japan.

Although the ability of external rewards, surveillance, and evaluation to undermine intrinsic motivation and creativity has been demonstrated in well-controlled studies (see above and reviews by Amabile, 1983, and Condry, 1977), the societal implications of an exam-system such as Japan's have not been researched. We do not know whether any impact on intrinsic motivation and creativity, if it exists, would be short-lived or permanent; whether it would extend to the full range of an individual's creative endeavors or a narrow domain of academic activities; whether the examination system places all individuals equally "at risk" or particularly affects those with initially low intrinsic motivation. An impressive feature of psychological research on intrinsic motivation is that seemingly trivial manipulations -- such as being promised a gold seal or filling out a questionnaire on extrinsic rewards -- can substantially undermine creativity. The major impact of

these small, one-shot interventions suggests that the impact of a major force such as the entrance examination may be dramatic indeed.

IV. CREATIVITY IN JAPAN: APPROACHES TO UNDERSTANDING AND MEASUREMENT

The preceding section outlines a number of the ways in which Japanese education and social practices may foster or inhibit creativity. What evidence is there regarding the level of creative activity in various domains of Japanese endeavor? This section reviews evidence on creativity in Japan. This has not been a focus of explicit research; where evidence exists, it is typically anecdotal or incidental to other research goals.

A. Innovation in Business and Industry

A well-worn part of the Western image of Japan is that the Japanese are imitators, good at producing high-quality, relatively inexpensive modifications of products made possible by foreign basic research and development. Japanese skills in borrowing and refining foreign inventions stretch back to the beginning of recorded Japanese history, and include a writing system borrowed from the Chinese and adapted, and military, educational and industrial systems modeled on those of European countries and the United States during the late 1800's. Yet, a key feature of Japanese borrowing throughout history has been modification and adaptation of borrowed technology. But the question remains

of whether Japan is "only" a skillful adaptor, or is also capable of the basic research and invention which provides the initial impetus for industrial and economic progress.

Vogel (1979) as well as experts on particular industries (e.g., Ishii, 1983; Gregory, 1984; Uchihashi, 1983) suggest that Japanese industry has shown considerable ability to innovate and conduct frontier-breaking research in areas of particular interest to Japan (e.g. new energy sources). Koizumi (1982) concludes from existing studies that "Japan now has a sizable advantage in overall technology over the United States...." (p.191) Ishii (1983), a professor of engineering, writes, "Evidence that Japanese technology is no longer a matter of improving on imported know-how, that it has developed into a creative technology of its own, can be found even in the disputes over technology that are breaking out between Japan and other countries." (p.11) Research cited by Lewis & Allison (1982) suggests that the U.S. share of major scientific and technological innovations has fallen from approximately 80% in the 1950s to approximately 50%, while Japan's share has risen. Japan may be particularly advanced and innovative in the information gathering and transmission technologies which some analysts consider the keys to the "information society" of the next century (Ishii, 1983; Vogel, 1979).

If patent rate is used as an index of creativity or innovation in Japanese industry, then innovation in Japan is increasing while that in the United States is decreasing.

Lewis and Allison (1982) report that both the absolute and relative number of patents issued to American firms on first-of-a-kind inventions declined in the 1966-1977 period, and that Japan's share of U.S.-issued patents increased during the same period. However, accounts suggest that Japanese companies may be much more eager to obtain patents on new developments than are their counterpart U.S. firms (Bhasavanich, 1985). Patents are a form of inter-company rivalry in Japan, and Japanese companies may go to the lengths of daily contact with the patent office to ensure that the maximum possible number of products become patented.

The per capita small business formation rate is another potential index of creativity in the sphere of business and industry. Small business does encompass a larger share of the economy in Japan than in the United States. For example, 2.8% of U.S. employees and 18% of Japanese employees work in manufacturing firms of fewer than 10 employees (Wood, 1985). Although many important innovations come from the small business sector, the proportion of innovative businesses within these figures is unclear, and many differences between Japan and the United States influence small business formation rate, including environmental and zoning regulations. Nevertheless, the figures may suggest a willingness of Japanese individuals to assume the risks and responsibilities associated with business formation. A study of 44 Japanese manufacturers by

Azumi, Hull, and Hage (1981) also suggests that amount of innovation (measured by patent filings) is inversely correlated with size of company. Azumi et. al.'s data support the notion that small firms may be more efficient than large firms in implementing employee-developed innovations. Azumi et. al. suggest that "The responsibilities of Japanese workers, unlike their American counterparts, often include finding better ways of performing."

Other indices which have been suggested as ways of comparing Japanese and American innovation in business include robot production numbers and national trade balances (Lewis & Allison, 1982; Moss, 1982); both indices reflect more favorably on Japan than on the United States. As noted for patent rate and small business formation rate, however, these indices probably reflect many extraneous factors in addition to creativity or innovation.

Another index of creativity -- though no simple measure presently exists -- is the commitment and motivation of workers. A recurring theme in case studies of Japanese business successes in new product development is persistence and individual willingness to champion a project within a company. Uchihashi (1983) describes the persistence of researchers at Toray Industries who were determined to develop a product using the basic technology they had invented for superfine fiber. The researchers were repeatedly rebuffed by company management, who told them

that to develop a product using such high-cost technology was out of the question. Nevertheless, the researchers persisted, and came up with the synthetic suede fabric "Ultrasuede" which carried Toray Industries through the textile recession, earning almost half the company's profits. Uchihashi makes the point that "masters," not professionals, are behind the development of winning technologies in Japan; these masters are zealous, devoted researchers who are not calm or rational in their delegation of energy, as are "professionals." Uchihashi writes : "For better or worse, zealous enthusiasm seems to be an indivisible part of the Japanese way of approaching technological development." (p.19) A study by Peters and Waterman (1982) of major business initiatives by Japanese and American firms reveals that presence of a volunteer "champion" was the best predictor of success both in Japan and the United States. The qualities of the "champion" are very much those of the "master" described by Uchihashi: zealous devotion to a goal, and a hands-on, rather than managerial, relationship with the product.

B. Creativity in the Sciences

Earlier this year, the Japanese Prime Minister's Advisory Council for Promotion of Administrative Reform recommended that the government promote the nation's science and technology by transforming its research system into a system attaching greater importance to basic research and to

creativity. This would mean a shift away from the current emphasis on applied research (U.S. National Science Foundation, 1985). The report of the Prime Minister's Advisory Council also called for "free and non-restrained" exchange of research among government, industrial, and academic research organizations within Japan. These recommendations seem to confirm the perception of many researchers that Japan's current system of research does not foster creative basic research, and that barriers preventing information flow among organizations are one major impediment to advances in basic research. The recommendations also represent an attempt to overcome this difficulty.

How can creativity in the basic sciences be measured? While Nobel Prizes are one indication of scientific creativity that show an overwhelming preponderance of American achievement, they tend to reflect work done many years in the past, and not in the present. Papers presented at international scientific meetings would provide a more current index of creative achievement. Figure 3 shows startling changes in the proportion of U.S., Japanese and European papers presented to meetings of two international societies of electronics researchers. I did not locate comparable data for presentations in other fields of research.

A third index of achievement in basic research is the flow of scientists from one country to another. For

example, a report on the international competitiveness of U.S. biotechnology firms indicates that more than 200 Japanese scientists are currently working at the United States National Institute of Health (Hubbard, 1985). Hubbard views this dispatching of researchers to the U.S. as an attempt to overcome the shortage of basic researchers trained in the techniques of genetic engineering in Japan. However, personnel exchange as an index of basic research achievement has major shortcomings. U.S. scientists apparently do not engage in foreign study to the extent that it would be scientifically appropriate. For example, Hubbard (1985) notes that American biotechnologists would profit from study at Japan's Fermentation Research Institute (Hubbard, 1985). Barriers may prevent U.S. scientists from study in Japan, including language barriers, reluctance to spend time out of the U.S., reluctance of foreign research institutes to house U.S. scientists, etc.. An additional recommendation of the Prime Minster's Advisory Council report cited above was to increase the number of foreign researchers at Japanese research facilities.

An additional source of information on creativity in the sciences in the two countries would be to interview researchers who have worked in both countries. I located no studies of this type. Informal discussions with Japanese biomedical researchers currently working in the U.S. suggested that lack of research funds for laboratory technicians, laboratory aides, disposable supplies, etc., is

a major disadvantage in Japanese basic research; customs or interpersonal styles which inhibit creativity were not mentioned by these researchers. However, this would be an important area for systematic research.

C. The Arts

The number of arts and crafts which are flourishing in Japan, attracting foreign visitors for study, and have even been transplated to the U.S. is noteworthy. Japanese brush-painting, calligraphy, pottery-making, flower arrangement, tea ceremony, and even joinery (carpenters' techniques for joining pieces of wood) have all been the focus of major books or exhibitions in the U.S. in recent years. The Japanese system of according important living artists "National Treasure" status has been proposed as a model for the United States. Nor is artistic endeavor confined to traditional forms in Japan; avant-garde Japanese art has made headlines in the U.S. as well as in Japan. Even crafts which are a part of daily Japanese life (origami, sushi-making, culinary garnishes) are considered "arts" by western writers who have introduced them to U.S. audiences. While I located no quantitative indices of artistic creativity in Japan and the U.S., the continuing popularity of the traditional art forms and the emergence of new art forms suggests that the arts are an area of continued vitality.

D. Interpersonal and Social Creativity

Some aspects of creativity in Japanese society may not be captured in the categories of creative endeavor, such as art and science, typically studied in the U.S.. There is an aspect of creativity I would like to call "interpersonal creativity," meaning an ingenuity for reasoning about the needs, feelings, and perspectives of others. A common thread in many accounts of successful Japanese business products is thoughtful reasoning about the needs of the consumer. For example, Japanese companies developed the first watches with alarms which automatically signal prayer time to millions of Moslem wearers, and the first TV's which maintain high picture quality under conditions of voltage variation which pertain in many countries (although such voltage variations are very rare in Japan compared to other countries). As Vogel (1979) has noted, Japanese companies gather a great amount and high quality of information about the countries where they operate. An ability to anticipate the needs of others (even if their lifestyles differ from the Japanese as widely as that of devout Moslems) is a feature of Japanese behavior worthy of study.

Learning to recognize and anticipate the needs and perspectives of others is a feature of early Japanese education (Lewis, 1984). Even during the elementary school years, Japanese children are more willing than their Australian counterparts to set up a classroom task in such a way that all students, rather than one's own subgroup, have

an equal chance of winning a prize. Speculatively, a preference for indirect feedback within Japanese culture may also foster children's tendency to reflect on the perspectives of others. There is some evidence that Japanese parents of preschoolers, compared to their U.S. counterparts, less often provide explicit feedback in response to their children's incorrect answers on a communication game (Azuma, Kashiwagi, & Hess, 1981). The same pattern does not appear to hold, however, for Japanese and American teachers. The relatively indirect style demonstrated by Japanese parents may foster children's skills in thinking about the attitudes and perspective of the other which were not clearly expressed (Kashiwagi, personal communication). What Americans call "vagueness" is a striking feature of the Japanese language, as typified in book titles such as "Twenty-five ways to avoid saying `no' in Japanese." If indeed opinions are not expressed directly, skills for inferring the attitudes and feelings of others may become critical survival skills, fostered by the lack of explicitness of Japanese social interaction.

Maccoby (1982) and Koizumi (1982) suggest that social innovation, not individual invention, is the key to increased productivity in the industrial world of the 1980's. Adapting new technology to the workplace in ways that do not "violate humanness" is a key creative challenge. Moss (1982) writes:

Our ability to understand and monitor the human

> behavioral factors and organizational interactions so important in social invention is primitive compared to our ability to manipulate materials and electronics. ... the success of societies that have emerged from time to time in world leadership roles can often be traced to an ability to develop and exploit effective new social arrangements which reinforced the value of technological developments. They successfully faced the challenge, in some measure, of harnessing human genius without foundering on human anxiety or other eccentricities. (p.240)

Koizumi (1982) suggests that a skill for "creative assimilation" has enabled the Japanese to adapt technology in ways that avoid alienation of workers from work. In Koizumi's view, "creative assimilation" involves "such a profound transformation of the original technology that it can only be characterized as the process of 'Japanization'." (p. 201). Others have suggested that systems in which workers have high autonomy and a high level of motivation will foster social innovation (Moss, 1982; Maccoby, 1982). Together, these observations suggest that assimilation of foreign technology, often considered an indication of Japan's lack of creativity, should actually be studied as a type of creativity, particularly with respect to the ways that workers' skills and knowledge contribute to "creative assimilation."

E. How Japanese Educators and Administrators Think About Creativity

In June, 1985, the Japanese Prime Minister's Provisional Council on Educational Reform issued its First

Report on Educational Reform, outlining the need for reform of the Japanese educational system and the directions reform should take. Increased creativity is one of the primary goals identified by the Council. In outlining the need for educational reform, the Council states: "It is the earnest hope of the public that our educational system restore vitality and creativity, as well as enriched humanity, and that our schools revive their primary function." It is worthwile to reproduce here the "eight basic concepts for reform" identified by the Council. Of the eight basic concepts listed below, the Council report identifies the first principle, "Puttting Emphasis on Individuality", as the "fundamental principle which is implied in all the other concepts."

1. Principle of Putting Emphasis on Individuality
2. Putting Emphasis on Fundamentals
3. Cultivation of Creativity, Thinking Ability, and Power of Expression
4. Expansion of Opportunities for Choices
5. Humanization of the Educational Environment
6. Transition to a Lifelong Learning System
7. Coping with Internationalization
8. Coping with the Information Age

The emphasis on reforms relevant or potentially relevant to creativity (e.g., cultivation of creativity, emphasis on individuality, expansion of opportunities for choices, etc.) is striking. My discussions with Ministry of

Education officials, educational researchers and educators in September, 1985, provided some information regarding the context of the reforms. One major impetus for the reforms is the examination system and its attendant pressures on the elementary and secondary school education. Foremost among these pressures is the need for examination-oriented teaching. This places a tremendous burden on teachers, who risk parents' wrath, jeopardy of the educational advancement of their students, and further exodus of children to exam-preparatory private schools if they deviate from the type of drill-oriented education required for the examinations. One Ministry of Education official with whom I spoke suggested that Japan's system of elementary education might be the best in the world, but that secondary and post-secondary education suffered greatly from the effects of examination-oriented education. Specifically noted were the compartmentalization of subjects (e.g., the fine points of English grammar are memorized, but English is not used as a tool for learning about science or literature), and the absence of opportunities for in-depth study of an area at the student's initiative. Although the official's assessment of Japanese elementary education was sanguine, the elementary school principals with whom I spoke saw examination pressure as a strong influence on education during the later years of elementary school. They reported that most upper-elementary school students attended juku, and that teachers worried that children's lives outside

school were consumed in studying. In questioning principals about their use of a weekly time set aside for special projects conceived by the school, I found that recreational activities, such as swimming, were one common use of this time. As one principal commented "It would be nice to use that time for special academic activities, like hands-on research, but the fact is that our students don't get a chance to play outside school. It's a funny state of affairs when school is the only chance for children to play."

The Report also links reform of the examination system to increased creativity and to contributions to international science:

> ...as we move into the 21st century, creativity and the ability to think, to express oneself and to act are particularly required for individuals. These qualities and competencies will be very important in the future also in order to enable our scientific research to make a relevant contribution to the international community. (p.28)

"Individualization" of education, the primary principle of the reform, has several aspects. One is correction of the "adverse effects of undue emphasis on the educational background of individuals." (p.34) As the report points out, in Japan "there is a tendency for the value of an individual to be evaluated not from a variety of angles, as it should be, but mainly in terms of the formal school background" obtained during youth and early adulthood. (p.34) The Report proposes efforts to evaluate students

"based on diverse relevant factors instead of the prevailing evaluation based on a single "deviation value" of students' scores on achievement tests." (p.35) An integral part of this diversification of evaluation is "to help students develop their individuality and creativity."

A second aspect of individualization is provision of education appropriate to the individual abilities and needs of students. The report declares that "uniformity, rigidity, closedness, and lack of internationalism" are "deep-rooted defects" of the Japanese educational system (p.26). The lack of adequate consideration to the "diverse personalities of children" and to children who cannot keep up with the rapid educational pace engendered by examination cramming are specifically mentioned. Thus, the report proposes expansion of educational choices as an objective.

It is noteworthy that the concern of Japanese educators with "individualism" may not be new. Based on school observations made during the 1970's, Cummings (1980) wrote:

> The schools and public institutions give much lip service to individualism. For example, in the middle school texts great stress is placed on the individual's right to choose his job.... However, the mass production-like character of schools does not allow much opportunity for individualized instruction or other means of encouraging individuality. (p.194)

In summary, the Report on Educational Reform confirms that creativity is an issue of concern among policy-makers. Problems in the development of creativity are explicitly linked to the examination system and to the type of

education which it engenders. The Report is unambiguous in linking greater creativity during elementary and secondary education to Japan's ability to make an international research contribution:

> ...over-emphasis on memorization in classroom instruction has prevented children from developing the ability to think and judge independently or from developing creative power. As a result too many stereotyped people have been produced who have no distinctive individuality.... In universities there are few activities of education and rsearch which have reached such a high standard as to be worthy of an international reputation. (p.18)

SUMMARY

As the foregoing pages suggest, simple conclusions about creativity in Japan are likely to be simplistic conclusions. Neither the basic research on the factors which promote and inhibit creativity nor the research on cross-national differences between the U.S. and Japan related to creativity is highly advanced. Yet, existing research suggests some tentative conclusions about the facets of Japanese education which may encourage or inhibit creativity. These are summarized below.

1. Mastery of Basic Skills

Substantial psychological research suggests that mastery of basic skills in a subject matter area is an essential prerequisite for creativity. Fluency with the

basic subject matter for an area is a quality which separates creative from non-creative individuals. There is ample evidence, from international tests, that Japanese education does an exceptionally good job of teaching basic skills in mathematics and science; evidence on literacy and accounts of Japanese schooling suggest that language, art, and music skills are also widespread and of a high level. Ethnographic evidence also suggests that drill and mastery of established forms is an integral part of traditional Japanese learning in the arts, and that creativity is considered to be a product of disciplined submission to established forms, rather than a prerequisite for artistic endeavor. It is unclear, however, whether students' memorization for examinations provides an informational base for later creativity; some psychological research suggests that rote memorization (in contrast to integration of information by meaningful principles) does not facilitate creativity.

2. Creativity-related Skills

Some evidence suggests that originality may be differently valued in the United States and Japan. For example, originality may help a child succeed in school in the U.S. but not Japan, and may be a more central part of the concept of intelligence in the U.S. than in Japan. Observations of Japanese schools suggest that original thinking, self-expression, and expression of feelings

through aesthetic pursuits are all fostered in the Japanese elementary school. These qualities are less apparent in Japanese secondary school teaching, but may be fostered in school-sponsored non-academic activities. The system of entrance examinations in Japan may screen out students with creative abilities who do not also "test well". For example, children with discrepant verbal and quantitative abilities and talents in domains not tested (e.g., leadership) may not enter higher education, or may enter higher educational institutions lower in prestige.

Problem-finding (noticing a problem where others do not) may be a creativity-related skill in which Japanese excel. This skill may be linked to a tendency to be unstatisfied with current levels of performance, or to choose a high standard of comparison. Accounts of Japanese product innovations suggest that dogged pursuit of solutions to "minor" problems ignored or not noticed by producers in other countries may underlie many Japanese product successes.

3. Motivation

Motivation is another area in which Japan may excel. Elementary and preschool education in particular are designed to promote children's intrinsic motivation to engage in work, avoid external rewards and punishments which might undermine children's intrinsic motivation, and foster children's commitment to rules and procedures which allow

the classroom to function well as a learning environment. Accounts of Japanese accomplishments in business suggest that persistence and motivation to succeed may be important components of Japanese business success. However, the examination system is a powerful external force which may undermine students' interest in the intrinsic rewards of learning. Some Japanese educators view Japanese post-secondary education as of low caliber compared to primary and secondary education and compared to to other countries; this is often attributed to the negative impact of the examination system on students' motivation.

4. New Approaches to Understanding and Measuring Creativity in Japan

Recent reports on several industries suggest that the stereotype of Japanese as "only" imitators incapable of creative innovations may be inappropriate. Some aspects of creativity in Japan may not be captured by the categories of creativity typically studied in the U.S. For example, Japanese creativity may show up in areas such as assimilating Western technology and in developing products responsive to the needs of users. Japanese creativity in these areas might be described as forms of interpersonal or social creativity. Examples include the development of work arrangements which allow workers to contribute to production innovations, and development of products finely tuned to the needs of the product users.

5. Summary of Factors which Promote or Inhibit Creativity

Although the state of knowledge regarding the determinants of creativity and regarding Japanese education is far from perfect, we might tentatively identify the following probable influences on creative development in Japan.

Factors which May Promote Creativity

1. Early childrearing is low in restrictiveness.
2. Preschool and elementary school education appear to promote conceptual integration of material, self-expression, and enjoyment of the intrinsic rewards of both academic and aesthetic pursuits.
3. Extrinsic rewards, such as grades and "motivators", which might undermine instrinsic motivation, do not appear to be widely used during elementary school.
4. A high level of training in basic skills is achieved in major academic subjects, and probably in other subjects (e.g., art, music) as well. A high level of training in component skills is a prerequisite for creativity.

Factors which May Inhibit Creativity

1. Examinations may provide a powerful external incentive which undermines intrinsic motivation; low intrinsic motivation is in turn related to low creativity.
2. Examination-oriented memorization may encourage use of memory strategies which focus on trivial aspects of

information, rather than on cross-cutting conceptual principles. The latter type of memorization strategy is more likely to faciltate creativity.

3. Greater demands for behavioral conformity and low valuation of originality may socialize Japanese children away from original approaches to schoolwork.

4. The examination system may screen out creative individuals whose interests or abilities are uneven across domains or whose particular creative abilities are not the target of testing.

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FIGURE 1

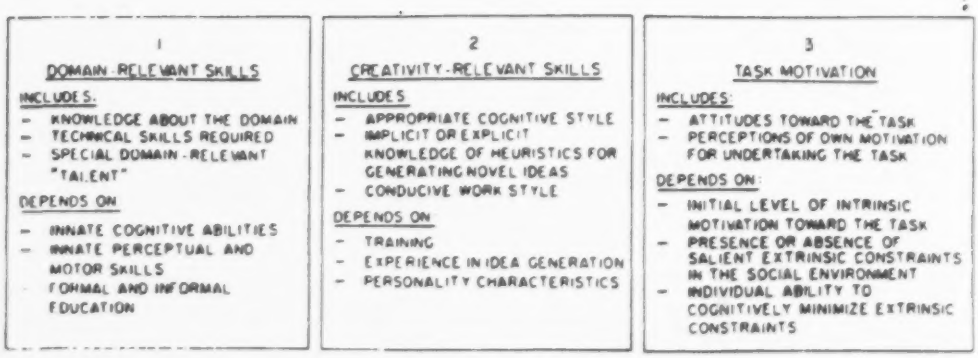
1
DOMAIN-RELEVANT SKILLS
INCLUDES:
- KNOWLEDGE ABOUT THE DOMAIN
- TECHNICAL SKILLS REQUIRED
- SPECIAL DOMAIN-RELEVANT "TALENT"
DEPENDS ON
- INNATE COGNITIVE ABILITIES
- INNATE PERCEPTUAL AND MOTOR SKILLS
- FORMAL AND INFORMAL EDUCATION
2
CREATIVITY-RELEVANT SKILLS
INCLUDES
- APPROPRIATE COGNITIVE STYLE
- IMPLICIT OR EXPLICIT KNOWLEDGE OF HEURISTICS FOR GENERATING NOVEL IDEAS
- CONDUCIVE WORK STYLE
DEPENDS ON
- TRAINING
- EXPERIENCE IN IDEA GENERATION
- PERSONALITY CHARACTERISTICS
3
TASK MOTIVATION
INCLUDES:
- ATTITUDES TOWARD THE TASK
- PERCEPTIONS OF OWN MOTIVATION FOR UNDERTAKING THE TASK
DEPENDS ON:
- INITIAL LEVEL OF INTRINSIC MOTIVATION TOWARD THE TASK
- PRESENCE OR ABSENCE OF SALIENT EXTRINSIC CONSTRAINTS IN THE SOCIAL ENVIRONMENT
- INDIVIDUAL ABILITY TO COGNITIVELY MINIMIZE EXTRINSIC CONSTRAINTS

Figure 1 Components of creative performance.

again, they are not sufficient in and of themselves. Certainly, a given individual—describable, perhaps, by a particular personality-trait constellation—is not creative at all times or in all domains, even if he or she does produce notably creative work in some. Fourth, innate abilities ("talents") in a given domain do appear to be important for noteworthy levels of creativity, but education seems essential in most outstanding creative achievements (Feldman, 1980). Fifth, although an eagerness to work diligently appears to be an essential component of high levels of creativity (Golann, 1963) and although a number of introspective accounts describe the phenomenology of creativity as marked by deep involvement in the activity at hand, these accounts also stress the importance of intellectual playfulness and freedom from external constraints (e.g., Einstein, 1949).

The componential framework of creativity outlined here attempts to account for these fairly well-established creativity phenomena: the importance of talents, education, cognitive skills, innate interests, and personality dispositions, all functioning interactively to influence creative behavior, as well as the apparently contradictory importance of both "work" and "play" in the motivation for creative behavior.

The Components of Creative Production

The proposed componential framework of creativity includes three major components, as outlined in Figure 1. In keeping with the consensual definition of creativity offered earlier, creativity, as used herein, refers to the production of responses or works that are reliably assessed as creative by appropriate judges. These three components, then, are presented as factors essential for the production of such responses and works.[2] Although it is proposed that the three main components constitute a complete set of the general factors necessary for creativity, the listing of elements within each component can only be completed gradually, as progress is made in creativity research. The elements included in Figure 1 within each of the components are proposed as examples of the kind of elements that each component contains.[3]

Within the framework, domain-relevant skills can be considered as the basis from which any performance must proceed. They include factual knowledge, technical skills, and special talents in the domain in question. Creativity-relevant skills include cognitive

[2] The term *factor* is used here in the colloquial sense of elements, circumstances, or conditions contributing to a process or outcome. This use is to be distinguished from the more narrowly statistical use of the term in the psychology of intelligence (e.g., Spearman, 1927).

[3] Sternberg (1977a, 1977b, 1978, 1979) has used the term *componential* extensively in his theory of human reasoning. There is a basic commonality between his and the present use of the term; in both conceptualizations, all of the components are seen as necessary, and the set is seen as essentially complete. Sternberg's conceptualization, however, is more highly developed; it is subdivided into hierarchical levels that include performance components, acquisition components, transfer components, retention components, and metacomponents (processes controlling the lower components). Although in Sternberg's model the components are processes, in the present conceptualization the components are sets of elements that control, determine, and enter into processes.

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then students trained to give the old answer should not be penalized. For reasons like this, the reform of the content of entrance examinations moves with glacial slowness. Each announcement of an intention to change the exams significantly is met with near panic by parents, teachers, and students. All fear that a disadvantage will be created for those who have been diligently preparing for the wrong questions. The content of examinations is, indeed, a sensitive public issue.

Following is a typical question that actually appeared on the Kobe University examination in 1974.[15] Kobe is an excellent national university just a notch or two below Tokyo. The question is from the social studies section.

> Select the appropriate answer for each numbered blank space from the list that follows the passage below. Fill in the dates directly.
>
> The philosophy that arose in ancient Greece had an enormous influence on subsequent human thought. The earliest form, (1) _____ philosophy, arose in the (2) _____ century in the (3) _____ region. Liberating itself from the mythological approach to natural phenomena, this philosophy aimed to explain the fundamentals of nature in a rational manner. (4) _____, who explained the origin of things to be water, and (5) _____, who treated the basis of matter mathematically, were representative scholars of the age. Following the war with (6) _____, democratic government was implemented with Athens as its focal point, and a school of teachers, the (7) _____, arose to give instructions to citizens in the arts of public debate. This development began the division of philosophy into component fields. As can be seen in the famous phrase, "Humans have many ways of measuring things," of (8) _____, the existence of absolute causality was denied by the assertion of subjective understanding. (9) _____ offered counter-arguments to this in his teaching. Known for his special questioning of students as a way of teaching them to understand the truth, he was misunderstood by his society and sentenced to death. One of his students, (10) _____, recorded his words and also bequeathed to the world a theory of idealism and a treatise on political utopia, and another student, (11) _____, drew together and synthesized all of existing Greek philosophy, for which he is now regarded as the figure representative of Greek learning at its zenith. In the latter half of the (12) _____ century, Hellenism arose, and, reflecting the decline of the democratic independent city-state, philosophy shifted from being primarily part of the education of a democratic citizenry to being part of the tendency to seek psychological solace and contentment. The (13) _____ school, which explained matters in terms of pleasure and pain, and the (14) _____ school, which sought to eliminate appetites, were characteristic of the age. Both subsequently spread to the aristocracy of ancient Rome, where Emperor (15) _____, who wrote his confessions, and the philosopher (16) _____ were representative figures.
>
> | | | |
> |---|---|---|
> | a. Academia | n. Dorian | aa. Enlightenment |
> | b. Aristides | o. Pythagoras | bb. Natural Philosophy |
> | c. Aristophanes | p. Plato | cc. Absolutism |
> | d. Antoninus Pius | q. Hesiod | dd. Stoic |
> | e. Euripides | r. Peloponnesus | ee. Socrates |
> | f. Cicero | s. Macedonia | ff. Thales |
> | g. Chrysippus | t. Mycenae | gg. Hadrian |
> | h. Constantine | u. Attica | hh. Phaedrus |
> | i. Natural Law | v. Aristotle | ii. Protagoras |
> | j. Existentialism | w. Archimedes | jj. Persia |
> | k. Seneca | x. Ionia | kk. Polybius |
> | l. Sophists | y. Epicurean | ll. Marcus Aurelius |
> | m. Solon | z. Xenophon | mm. Laconian |
>
> Answers:
> (1) i, (2) 6th B.C., (3) x, (4) ee, (5) o, (6) ii, (7) l, (8) hh, (9) ee, (10) p, (11) v, (12) 4th B.C., (13) y, (14) dd, (15) kk, (16) k.

15. Questions are quoted from a book entitled *Kobe Daigaku*, published by Kyogakusha (1974), one of an extensive annual series on the entrance exams of over 350 universities.

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I selected this question because it is about a time and place in history supposedly more familiar to Western than to Japanese students. Questions related to Chinese and Japanese history also appear, of course, but for those of us without the necessary background they are more difficult to evaluate. The style of the questions does not show geographical variation.

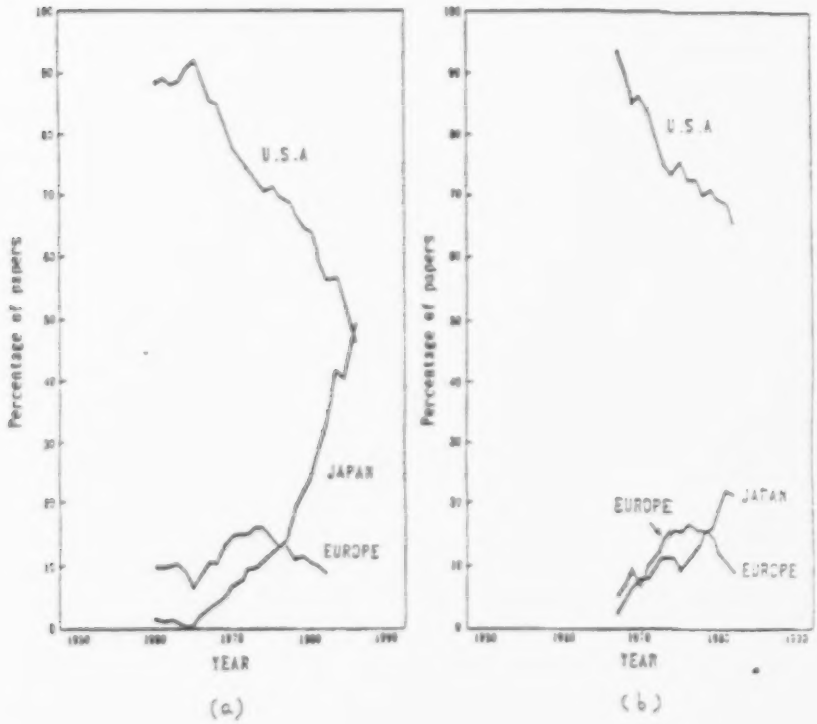
How many American high school seniors would even want to attempt answering this question—one about their own tradition? Very few, of course. Our education is not geared to this sort of testing, even when it does take up ancient civilization as a subject. The American sense of education rebels at the thought that the way to learn about Greek thought is to master the names, dates, places, eras, schools of philosophy, and philosophical lineages involved. We want to focus on the essence of what we think the Greeks valued—independence of thought and rationality—two items that tests do not reliably measure.

FIGURE 2

Fig. 1 The number of papers presented at ISSCC and IEDM from the United States, Europe and Japan.

(a) ISSCC (International Solid State Circuit Conference)

(b) IEDM (International Electron Device Meeting)



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